some distance beyond his abiding-place by reason of mental pre-occupation. There are two lines of cerebral action going on at once, — one, the active mental study which engrosses him; the other, the unconscious action that keeps him out of danger from passing vehicles, or from other causes incident to city life. The limitation of direction which Professor Newcomb regards as exceptional, I consider as general: i.e., I believe that there are vastly more men who have no definite idea of lines as a standard of reference, than there are those who refer every thing in direction to such co-ordinates; just as there are many who never have any definite idea of the cardinal points of the compass, either as real or ideal points, and who never arrive at any clear conception of the bearings of familiar buildings, or the direction of streets, though they may live in the same city for years. The domination or tyranny of a fixed idea is explanatory of the difficulty which Professor Newcomb experiences. His ideal or subjective west was the domination of a fixed idea indelibly imprinted upon the super-sensitive cerebral cortex of youth, not necessarily associated with ideal or absolute direction, or with any system of horizontal lines, but an isolated conception, formed out of the perception of different positions, which in early youth could hardly be correlated with any abstruse reasoning. This idea of west, once ingrafted upon a developing brain, became a fixed factor, so dominant as to tyrannize over the understanding, and so persistent as to require some moments of study to dispel the illusion. This becomes evident from an analysis of his third division. The tyranny of the early idea has usurped control over the will, and, indeed, over the whole cerebral outcome. Even though the internal evidence corresponds with the external bearings to show that his preconceived west is really *not* west, but some other point, yet so strong is the power of this subjective idea, that by no process of argument can he rid himself of it. This is not uncommon, but by no means of frequent occurrence. But it is not a normal harmony of relation between the various reciprocal functions of the brain. It is likened to a habit formed in youth, so strong as to be ineradicable in manhood, and has been studied with much care by psychologists. Again: one may be mistaken as to direction, or become confused in tracing his route through the intricacies of his hotel, without associating such perversions with any states of subjective consciousness, so far as these states may involve the consideration or differentiation of the 'co-ordinates.' A man who is ignorant of the cardinal points of the compass, and who never can tell in which direction he is facing, loses his way because he has lost his bearings: the road was known by reason of the association of other facts, — a certain house just here, or a lamp just there, — and not because his horizontal lines have led him astray. In view of what we have learned of unconscious cerebral action, of habit, of the association of ideas, of the tyranny of a fixed idea, and of subjective states of consciousness leading on to abnormal objective conditions, it seems to me that Professor Newcomb's case is not an isolated one, and that what he has written of himself has already been written of and discussed.

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Colorado climate.

For the benefit of other sufferers, please allow me to correct what is likely to lead to an erroneous impression, on reading Dr. Fisk's article on 'Climate in the cure of consumption,' as published in SCIENCE of Oct. 5. Dr. Fisk, in his very able article, like most of those who have written of the fitness of the climate of Colorado for consumptives, speaks as though Denver City were Colorado, and *vice versa*.

Now, this unintentionally misleading impression is calculated to do serious harm. During the late spring, and in summer and autumn, Denver and neighboring localities may be quite as pleasant and beneficial to the consumptive as localities south of the 'divide' that separates the waters of the Platte from those of the Arkansas.

But, during the cool and cold months, the Arkansas valley furnishes a very much better climate than can be found anywhere north of this divide in Colorado. It is scarcely necessary to state that the Arkansas valley furnishes all the necessary comforts of civilization, including convenient railroad transportation. As a rule, with rare exceptions, the consumptive should not sojourn in towns or cities, but rather in rural districts. But, should the consumptive prefer town or city life, Pueblo, Cañon City, and other places in the Arkansas valley, afford ample accommodation.

Having long been a sufferer myself, and having sought health in many portions of North America, I speak of the before referred to localities from observation and experience, and without prejudice or pecuniary interest. Q. C. SMITH, M.D.

Austin, Tex., Oct. 18, 1883.

[Dr. Fisk's article was written with especial reference to Denver, as the necessary data exist for that place, furnished by the records of the signal-service station: these do not exist for localities in the Arkansas valley. — EDITOR.]

A BIOGRAPHICAL HISTORY OF ASTRONOMY.

Heroes of science — astronomers. By E. T. C. MORTON, B.A., scholar of St. John's college, Cambridge. London, *Society for promoting Christian knowledge*, [1882.] 341 p. 16°.

FROM the title, 'Heroes of science — astronomers,' one might expect to find in this little book an account of the lives and a eulogium of the characters of the greatest astronomers, with some general indication of the nature of their discoveries. This expectation would be partially corrected by the opening paragraphs of the preface: —

"The primary object of this little book is, as its name implies, to give some account of the lives of the chief astronomers. But it is impossible to leave in the mind of the general reader any clear notion of their characters, without giving some account of their work. A good deal of space is therefore taken up with explanations of their discoveries; but, as this is only of secondary importance, the explanations are given in a popular manner, and no mathematics is introduced, except in ten pages (172–182), where a knowledge of the first book of Euclid and of the elements of algebra is assumed.

"The book may possibly be useful as an introduction to the study of astronomy, and, in this aspect of it, it is hoped that it may be helpful in two respects: First, by putting before the student the personal difficulties which the first investigators of the law

of the stars met with, and the struggles they passed through to overcome them, whereby a human interest is given to the study of their work; and secondly, by clearly indicating the nature of the problems to be solved by the science."

In point of fact, however, the book does much more than this: it presents a clear, connected, readable account of the chief steps in the progress of astronomy from the earliest times to the present day; and while the lives of the astronomers, judiciously inserted and as a rule well told, greatly heighten the interest of the story of the science, the reader always feels that they are only the accidents of the book, while the unfolding of the successive triumphs of astronomy, and the exposition of its laws, objects, and methods, is its constant purpose.

Interesting and readable as the book is almost throughout, we nevertheless think the author mistaken in regarding it as well adapted to serve as an *introduction* to astronomy for non-mathematical readers. It is true that only very elementary mathematics is explicitly introduced; but few readers who are not either equipped with the habits of thought bred by mathematical study, or possessed of some familiarity with the outlines of astronomy, can follow intelligently and with interest the discussion of complicated motions. To young people who have gone through an elementary course in astronomy, on the other hand, the book before us will be most instructive and stimulating. The subject is vivified, not only by the presentation of the lives, so full of inspiration, of the great founders of the science, but also by a far clearer view of its progressive development than an ordinary text-book can afford. And the impression is not weakened by the introduction of insignificant details, or of merely statistical information. Not that details are avoided when they are necessary to the exposition or illustration of a great law, or of an important phenomenon: on the contrary, one is surprised at the number and diversity of the points which are explained, and in general clearly and satisfactorily explained. The author has not refrained from giving simple expositions of mechanical and physical laws when they are essential to the clear understanding of astronomical doctrines. By explaining the laws of motion, for example, and insisting on their fundamental importance, he puts the reader in a position to understand the great problem of physical astronomy, and to appreciate its solution. In connection with spectrum analysis, a little space devoted to the analogy between sound and light makes the subject clear to the average reader. And many other instances might be mentioned.

As the character of the book does not make it incumbent upon the author to present any thing like a complete survey of even the most prominent astronomical facts, he is able to give a much fuller exposition of the central points in the theory of astronomy than one would expect to find in so limited a space, and to give intelligible accounts of many things having a direct connection with these central principles, which are usually passed over with a bare mention in small works on astronomy. Thus, more than eighty pages are devoted to Newton, only a small portion of which is biographical, a whole chapter of fifty pages being specifically devoted to the Principia. And pretty full accounts are given, for example, of Herschel's theory of stellar distribution, of the nebular hypothesis, of Laplace's proof of the stability of the solar system and Lagrange's previous attempts in that direction, and of the recent researches of Mr. G. H. Darwin.

It would be quite possible to point out minor defects in the book. There is occasionally (but very seldom) an attempt to explain what cannot be satisfactorily explained in a popular manner; once in a while the demonstrations, which are usually in excellent and attractive form, are made pedantically stiff; there are a few inaccuracies, chiefly of expression; and there are possibly a few cases of Sunday-school moralizing from insufficient premises. The only instance we have noticed of unfairness in the historical portion is in the passage relating to the Mohammedan astronomers. Scant justice is done them; and the author permits himself to combine silliness with injustice in saying that 'it illustrates the slavish stupidity of the race,' that a discovery made by an Arab astronomer in the tenth century was afterwards forgotten by them! A grave defect, but one which can easily be remedied in a new edition, lies in the lack of an index, — an omission which seriously impairs the value of this very interesting and useful work. In conclusion, lest we should leave the impression that the book can be read with advantage only by students, we would say that the chapters which combine in the highest degree biographical with scientific interest, — those on Copernicus, Tycho Brahe, Kepler, and Galileo, — and many other parts of the book, may be read with great pleasure and profit by a very wide circle of readers.